DECLARATION

I, Takao MARUYAMA, a Japanese Patent Attorney registered No. 8425, having my business office at SAM Bldg., 38-23, Higashi-Ikebukuro 2-chome, Toshima-ku, Tokyo 170-0013, Japan, solemnly and sincerely declare that I have a thorough knowledge of Japanese and English languages, that I made an English translation attached hereto, and that to the best of my knowledge and belief the translation is a true and correct reproduction of the original documents filed with the Japanese Patent Office in respect of Japanese Patent Application No. 2001-050345 on February 26, 2001 in the name of NEC Engineering, LTD.

Signed this 25th day of August, 2005

Takao Maruyama
Patent Attorney

JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: February 26, 2001
Application Number: Patent Application No. 2001-050345
[ST. 10/C]: [JP2001-050345]
Applicant(s): c/o NEC Engineering, Ltd.

March 5, 2002

Commissioner, KOZO OIKAWA
Japan Patent Office
(Seal)
Certificate No. 2002-3013805

[Title of Document] Request for Patent

[Reference Number] 00722630

[Submitting date] February 26, 2001

[Address] To Honorable Commissioner of the Patent Office

[International Classification] H04M 19/00

[Title of Invention] TELEPHONE POWER SOURCE CIRCUIT

[Number of Claims] 7

[Inventor]

[Address or Residence]

c/o NEC Engineering, Ltd., 18-21, Shibaura 3-chome, Minato-ku, Tokyo, Japan

[Name] MASAHARU TOMOBE

[Applicant]

[Discrimination Number] 000232047

[Name or Title] NEC Engineering, LTD.

[Agent]

[Discrimination Number] 100081710

[Patent Attorney]

[Name or Title] MASAHIRO HUKUYAMA

[Indication of Charge]

[Ledger Number of Payment in Advance] 030797

[Amount of Payment] 21000

[List of Objects Submitted]

[Title of Object] Specification 1

[Title of Object] Drawings 1

[Title of Object] Abstract 1

[Number of Inclusive Power of Attorney] 9600633

[Necessity of Proof] Necessity

[Title of Document] Specification

[Title of the Invention] TELEPHONE POWER SOURCE CIRCUIT

[Scope of Claim for Patent]

[Claim 1]

A telephone power source circuit for an IP (Internet Protocol) telephone connected to a network, in which a direct current with a signal is received via the network for charging an input capacitor to thereby obtain operation voltage of each constituent components of the IP telephone, comprising:

a DC/DC (Direct-Current to Direct-Current) converter for obtaining a voltage to charge the input capacitor; and

an input current limiting register connected to an input terminal of the DC/DC converter for limiting the direct current input from the network.

[Claim 2]

The telephone power source circuit claimed in claim 1, further comprising an input voltage sensor circuit for monitoring an input voltage to the DC/DC converter, an output from the DC/DC converter being delayed according to a result of the monitoring by the input voltage sensor circuit.

[Claim 3]

The telephone power source circuit claimed in claim 1 or 2, wherein the input capacitor has a capacity of about 100 μF.

[Claim 4]

The telephone power source circuit claimed in one of claims 1 to 3, further comprising a limit removing means for removing the limitation imposed by the input current limiting resistor.

[Claim 5]

The telephone power source circuit claimed in claim 4, wherein the limit removing means is a switching transistor connected in

parallel with the input current limiting resistor.

[Claim 6]

The telephone power source circuit claimed in claim 5, wherein the switching transistor is driven by a driving transistor, which operates according to a voltage received via a delay circuit from the DC/DC converter.

[Claim 7]

The telephone power source circuit claimed in claim 5, wherein the telephone includes a CPU (Central Processing Unit), and the CPU determines control timing for turning on or off the switching transistor.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a power source circuit, and in particular, to a telephone power source circuit for supplying an IP telephone with electric power necessary for operation of constituent components of the IP telephone.

[0002]

[Prior Art]

A telephone power source circuit of this kind has been disclosed, for example, in Japanese Patent Laid-Open No. HEI 8-9071 entitled "Power Source Circuit for Communication Apparatus" and Japanese Patent Laid-Open No. 2000-69206 "Power Supply System for LAN Compatible Telephone Terminal". In these systems of the prior art, the power source circuit is simply connected to a DC/DC converter. Therefore, the systems cannot cope with a hub which can supply power to devices such as IP telephones which are expected to be broadly used in future.

[0003]

Figs. 3 and 4 are circuit diagrams of a power source circuit of the

prior art according to Japanese Patent Laid-Open No. HEI 8-9071. First, as shown in Fig. 3, the power source circuit of the communication apparatus receives a 100-volt a-c supply (commercial power source) 12. The circuit includes a main power source 11 to transform the input power 12 according to capacity of the system, for example, into –48-volt d-c supply (for large capacity) or –24-volt d-c supply (for small capacity). The system further includes a power source circuit 10 which includes input terminals 1a and 1b and output terminals 5a and 5b, and which receives the DC voltage to produce a stabilized voltage. To stabilize the output voltage (-48 volt d-c), the power source circuit 10 includes an input voltage detector circuit 2, a power source controller circuit 3, and a DC/DC converter 4 between the input terminals 1a and 1b and the output terminals 5a and 5b.

[0004]

Fig. 4 shows the power source circuit 10 of Fig. 3, and particularly a concrete circuit configuration of the input voltage detector circuit 2 and the power source controller circuit 3. The input voltage detector circuit 2 includes a pnp-type transistor Tr1, a series circuit which includes a zener diode Z1 and a register R1 and which is connected between the input terminals 1a and 1b, and a resistor R2 connected in series between a connecting point between the diode Z1 and the resistor R1 and a base of the transistor Tr1. On the other hand, the power controller circuit 3 includes a series connection of a zener diode Z2 and a resistor R3 between the input terminals 1a and 1b, a pnp-type transistor Tr2, and a resistor R4 coupled between a collector of the transistor Tr2 and the input terminal 1a. The zener diode Z2 is connected to a collector and an emitter of the transistor Tr1 at both ends. A base of the transistor Tr2 is linked to a connecting point between the zener diode Z2 and the resistor R3. The DC/DC converter 4 includes four terminals 4a to 4d. The terminals 4a and 4d

are coupled with the output terminals 5b and 5a, respectively. The terminal 4c is connected via a diode 6 to the output terminal 5a. The terminal 4b is linked with an emitter of the transistor Tr2.

[0005]

A power source hub connected to an IP telephone network generally available in the market is specified in two ways as below.

Specification A: A rush current has a maximum value of about 400 mA (milliampere) when an IP telephone is connected to the hub.

Specification B: After input capacity of an IP telephone is detected, the hub starts supplying power thereto. The input capacity is measured using a fixed current and must be in a range from 47 μF (microfarad) to 470 μF. Therefore, it is required that the DC/DC converter of the IP telephone starts producing its output after the input capacity is completely charged.

[0006]

[Problems that the Invention is to Solve]

However, the prior art described above cannot cope with a plurality of hubs or IP telephones of different power supply types such as specifications A and B.

[0007]

[Object of the Invention]

It is therefore an object of the present invention to provide a telephone power source circuit of a relatively simple configuration capable of coping with a plurality of hubs of different power supply types.

[0008]

In accordance with the present invention, there is provided a telephone power source circuit for an IP telephone connected to a network, in which a direct current with a signal is received via the network for charging an input capacitor to thereby obtain operation

voltage of each constituent components of the IP telephone, comprising a DC/DC converter for obtaining a voltage to charge the input capacitor, and an input current limiting register connected to an input terminal of the DC/DC converter for limiting the direct current inputted from the network.

[0009]

In accordance with the present invention, the telephone power source circuit further comprises an input voltage sensor circuit for monitoring an input voltage to the DC/DC converter, and an output from the DC/DC converter is delayed according to a result of the monitoring by the input voltage sensor circuit. The input capacitor has a capacity of about 100 μF. The telephone power source circuit further comprises a limit removing means for removing the limitation imposed by the input current limiting resistor. The limit removing means is a switching transistor connected in parallel with the input current limiting resistor. The switching transistor is driven by a driving transistor, which operates according to a voltage received via a delay circuit from the DC/DC converter. The IP telephone includes a CPU, and the CPU determines control timing for turning on or off the switching transistor.

[0010]

[Embodiment of the Invention]

Referring next to the accompanying drawings, description will be given in detail of a configuration and operation of an embodiment of a telephone power source circuit in accordance with the present invention.

[0011]

Fig. 1 shows in a block diagram a configuration of an IP telephone including a telephone power source circuit in accordance with the present invention. The IP telephone 20 includes a power

source circuit 21, a connector 22 of RJ45 type, a separator 23, a transmitter circuit 24, a CPU 25, and a telephone circuit 26. The connector 22 is directly connected to a network 27. The separator 23 receives a signal via the network 27 and separates a digital signal from a direct current contained in the signal. The transmitter circuit 24 terminates a physical layer of the network 27. The CPU 25 controls operation of the IP telephone 20. The telephone circuit 26 includes an audio circuit, a microphone, a speaker, a dial button, a facsimile switch, and the like. The power source circuit (telephone power source circuit) 21 in accordance with the present invention supplies power necessary for operation of the respective constituent components of the IP telephone 20.

[0012]

Fig. 2 shows a configuration of an embodiment of the telephone power source circuit 21 shown in Fig. 1. The telephone power source 21 includes a current limiting resistor 31, a transistor (a limit removing means or a switching transistor) 32, a driving transistor 39, an input capacitor 33, a DC/DC converter 34, an input voltage sensor circuit 36, a delay circuit 37, and a base limiting resistor 38. The DC/DC converter 34 includes a delay circuit 35. An emitter and a collector of the transistor 32 respectively connected to an end and another end of the resistor 31. A base of the transistor 32 is grounded via the resistor 38 and a collector and an emitter of the transistor 39. The DC/DC converter 34 applies an output voltage via the delay circuit 37 to a base of the transistor 39. The DC/DC converter 34 is connected to a connecting point at which the resistor 31, the collector of the transistor 32, and the input capacitor 33 are connected to each other. A voltage at the connecting point is applied via the input voltage sensor circuit 36 to the delay circuit 35 of the DC/DC converter 34.

[0013]

The resistor 31 is an input current limiting resister which limits an input current supplied to the circuit system. The transistor 32 removes a current limitation imposed by the input current limiting resistor 31. The input capacitor 33 is disposed to remove an input ripple of the DC/DC converter 34. To satisfy the specification B described above, the input capacitor 33 has a capacity of about 100 μF. The DC/DC converter 34 produces a stabilized output voltage regardless of variation in the input voltage. The delay circuit 35 delays the input voltage supplied to the DC/DC converter 34. The input voltage sensor circuit 36 senses the input voltage and interrupts the output from the DC/DC converter 34 for a predetermined period of time. After the output voltage from the DC/DC converter 34 is sensed, the delay circuit 37 turns the driving transistor 39 on (sets the transistor 39 to a conductive state) with a delay of a predetermined period of time to thereby removes the current limitation imposed by the current limiting resistor 31. The resistor 38 limits a base current of the transistor 32. The transistor 39 turns the transistor 32 on or off by an output from the delay circuit 37.

[0014]

Referring now to Figs. 1 and 2, description will be given in detail of operation of the telephone power source circuit in accordance with the present invention. The signal on the network 27 includes a signal and voice to be communicated with the IP telephone 20 and a direct current to operate the IP telephone 20. In the IP telephone 20, the separator 23 separates the signal from the direct current. The signal is input to the transmitter 24, and the direct current is supplied to the power source circuit 21. The power source 21 supplies each constituent circuit block of the IP telephone 20 with its operating power. The CPU 25 to control the overall operation of the IP telephone 20 controls the telephone circuit 26 achieving basic operations such as a telephone call

and a dialing operation. The CPU 25 also communicates via the transmitter circuit 24 with the network 27 so that the IP telephone 20 conducts necessary operations.

[0015]

The power source circuit 21 shown in Fig. 2 operates as follows. In an initial state, the DC/DC converter 34 does not sends its output to the delay circuit 37, which accordingly does not produce its output to the transistor 39. Therefore, the transistors 39 and 32 are off (non-conductive). When the network 27 starts supplying a signal and power to the circuit system, a current of the power is controlled by the current limiting resistor 31 to charge the input capacitor 33. Until the charged voltage of the input capacitor 33 reaches a predetermined value, the input voltage sensor circuit 36 interrupts the output from the DC/DC converter 34.

[0016]

After a designated period of time provided by the delay circuit 37, the DC/DC converter 34 supplies the output voltage to all constituent circuits of the IP telephone 20 shown in Fig. 1 to resultantly start operation of the IP telephone 20. However, in a state in which a maximum power consumption load is imposed onto the IP telephone 20, there exists a fear that the IP telephone 20 cannot conduct a normal operation because of power loss by the current limiting resistor 31. The operation of the IP telephone 20 with the maximum power consumption load is guaranteed as below. When the converter 34 produces its output, the transistor 39 is turned on (set to a conductive state) after a predetermined delay time provided by the delay circuit 37. This sets the transistor 32 also to a conductive state. Therefore, the influence of the current limiting resistor 31 is removed and the operation with the maximum load is guaranteed. Since power consumption of the current limiting resistor 31 is reduced, the overall

power consumption of the IP telephone 20 is also lowered.

[0017]

The configuration above resultantly satisfies the specified current of 400 mA of the rush current when the system is connected according to the specification A described above. On the other hand, when the system is connected according to the specification B, the input voltage sensor circuit 36 keeps the output voltage from the DC/DC converter 34 from turning on (keeps the DC/DC converter 34 from being set to a conductive state) until the charged voltage of the input capacitor 33 reaches a predetermined value, and hence the correct capacity can be kept retained. Therefore, the requirement of the specification B is also satisfied by the configuration of the power source circuit in accordance with the present invention.

[0018]

In the embodiment above, when the converter 34 produces an output voltage, the transistor 39 is turned on to a conductive state after a lapse of a predetermined period of time provided by the delay circuit 37. However, the transistor 39 may also be controlled by the CPU 25 in the IP telephone 20. The CPU 25 supervises all control operations of the IP telephone 20 and can hence easily recognize power being presently consumed by the IP telephone 20. The CPU 25 can therefore detects timing to invalidate the current limiting resistor 31 using the current power consumption of the CPU 25 to thereby more precisely control the operation.

[0019]

Description has been given of a configuration and operation of an embodiment of the telephone power source circuit in accordance with the present invention. The embodiment is only an example embodying the present invention, and hence the present invention is not restricted by the embodiment. It will be easy for those skilled in the art to

change or to modify the embodiment for various purposes within the scope and spirit of the present invention. For example, an FET (Field-Effect Transistor) and/or an MOS (Metal-Oxide Semiconductor) may be used as the switching transistor 32 and the driving transistor 39.

[0020]

[Effect of the Invention]

As described above, the telephone power source circuit in accordance with the present invention leads to practical advantages as below. The requirements of IP telephones of specifications A and B can be satisfied. This is because the input capacitor is charged via the current limiting resistor and the limit removing means (a switching transistor), and the charged voltage is sensed by the input voltage sensor circuit to resultantly drive the DC/DC converter. Additionally, in accordance with the present invention, the telephone power source circuit can be constructed in a simple configuration.

[Brief Description of the Drawings]

[Fig. 1]

A block diagram showing a configuration of an IP telephone to which a power source circuit in accordance with the present invention can be applied.

[Fig. 2]

A diagram showing the configuration of an embodiment of a telephone power source circuit in accordance with the present invention.

[Fig. 3]

A block diagram showing a power source circuit of a conventional communication device.

[Fig. 4]

A diagram showing the configuration in detail of the power source circuit shown in Fig. 3.

[Description of Codes]

20 IP telephone
21 Telephone power source circuit
22 Connector
23 Separator
24 Transmitter circuit
25 CPU (Central Processing Unit)
26 Telephone circuit
27 Network
31 Input current limiting resister
32 Limit removing means (switching transistor)
33 Input capacity
34 DC/DC converter
36 Input voltage sensor circuit
37 Delay circuit
39 Driving transistor

[Title of Document] Specification

[Abstract]

[Problems] To provide a telephone power source circuit which copes with a plurality of hubs of different power supplying specifications in an IP (Internet Protocol) telephone network in which telephones are connected to a local-area network of the IEEE802.3 standard and the like.

[Means for Solving]

In the telephone power source circuit, a direct current from a network 27 is used to charge an input capacitor 33 via an input current limiting resistor 31. A resultantly charged voltage is inputted to and is converted by a DC/DC converter 34 to produce an output voltage. In parallel with the input current limiting resistor 31, a limit removing means including a switching transistor 32 is arranged. The output voltage is delayed by a delay circuit 37 to activate a driving transistor 39, which drives the switching transistor 32. The input voltage to the DC/DC converter 34 is monitored by an input voltage sensor circuit 36.

[Selected Drawing] Fig. 2

[Title of Document] Drawings

FIG. 1

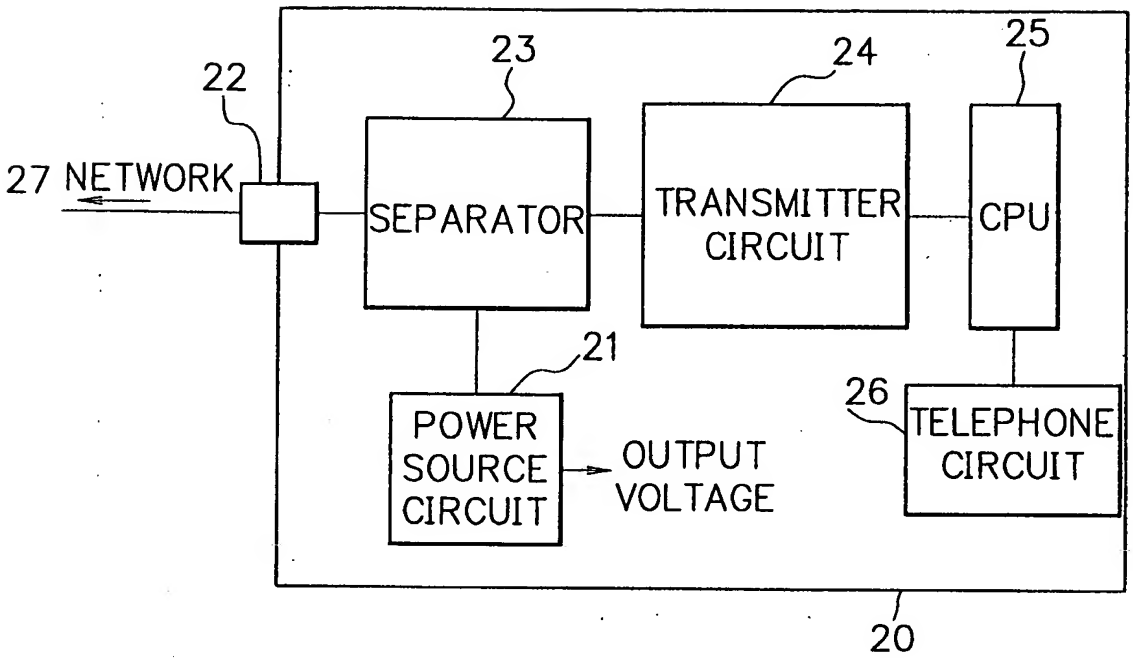


FIG. 2

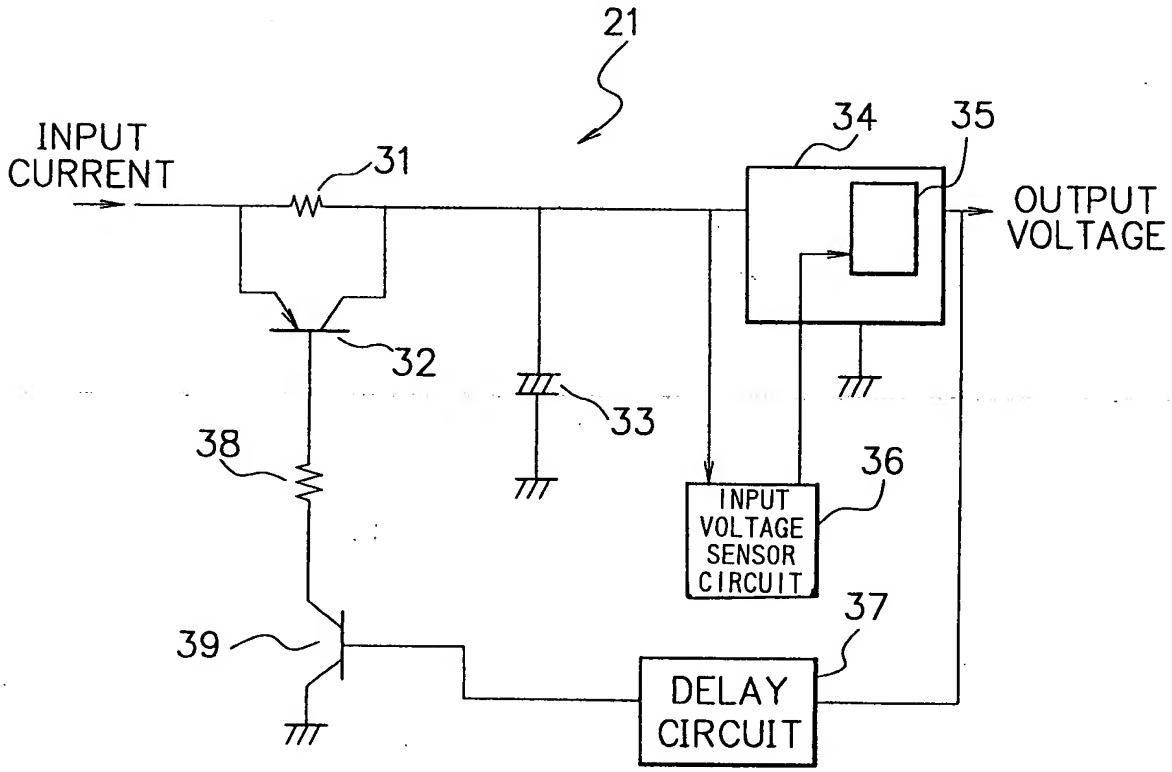


FIG. 3

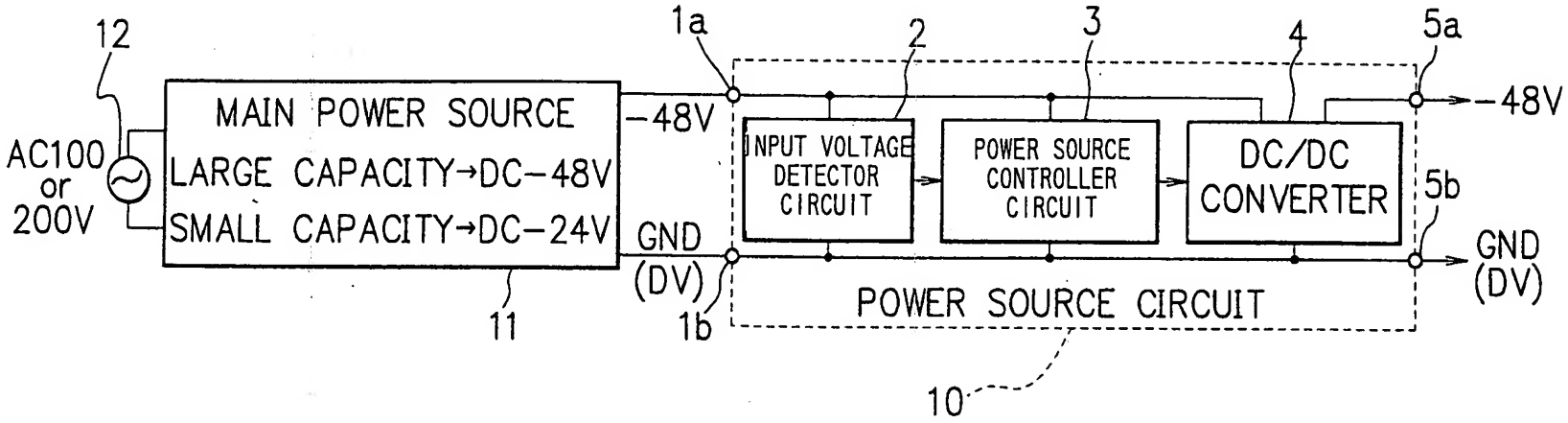
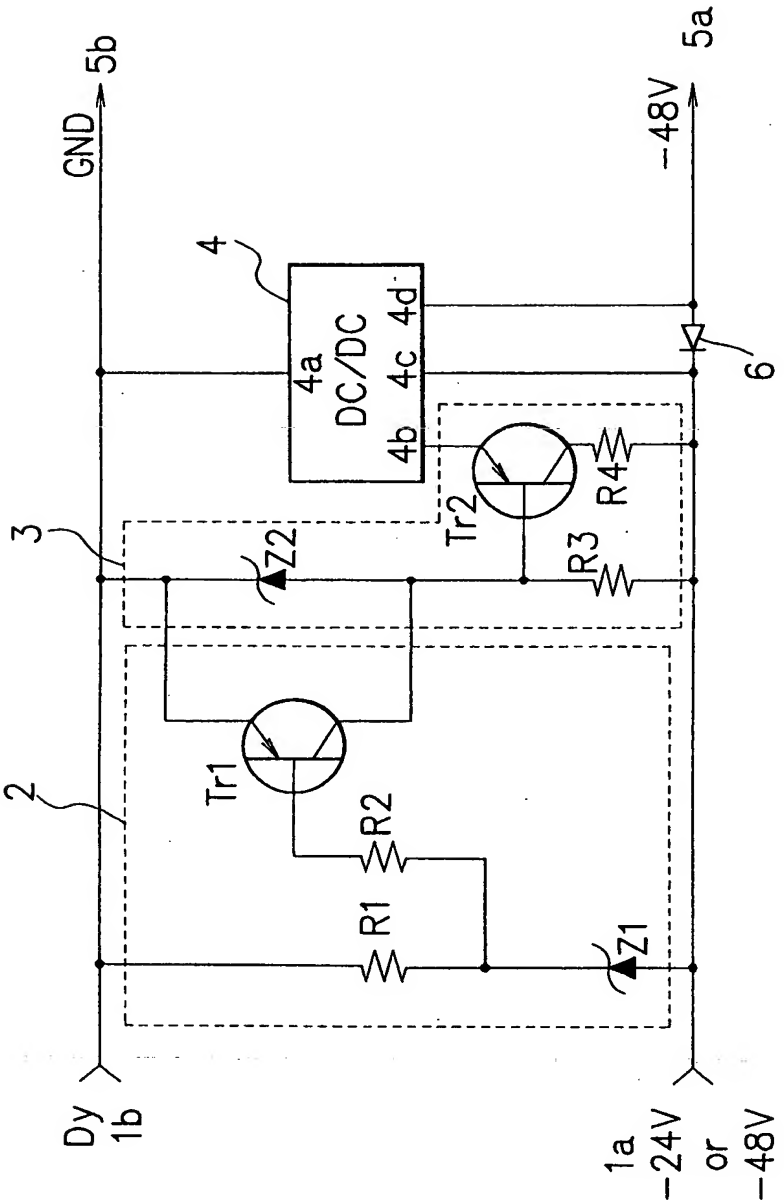

12
AC100
or
200V
MAIN POWER SOURCE
LARGE CAPACITY→DC−48V
SMALL CAPACITY→DC−24V
11
−48V
GND
(DV)
1a
1b
2
3
4
5a
5b
INPUT VOLTAGE DETECTOR CIRCUIT
POWER SOURCE CONTROLLER CIRCUIT
DC/DC CONVERTER
POWER SOURCE CIRCUIT
10
−48V
GND
(DV)

FIG. 4


GND
5b
−48V
5a
4
4a
DC/DC
4b
4c
4d
6
3
Z2
Tr2
R4
R3
2
Tr1
R2
R1
Z1
Dy
1b
1a
−24V
or
−48V